



Laparoscopic appendicectomy: calculating the cost

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ABSTRACT

INTRODUCTION Laparoscopic appendicectomy is a commonly performed procedure presenting a considerable cost burden. Given the additional operative costs of laparoscopic versus open appendicectomy, it is not clear whether the national tariffs are appropriate for laparoscopic appendicectomy. We conducted a study to establish the institutional costs, and to determine whether re-imbursement according to the national tariffs was sufficient.

PATIENTS AND METHODS Data were collected prospectively on patients undergoing laparoscopic appendicectomy within Leeds Teaching Hospitals Trust. Theatre and bed costs were obtained. Cost analysis was performed, and costs were compared to the re-imbursement due.

RESULTS Fifty laparoscopic appendicectomies were performed. Median operative time was 60 min. The median total operative cost of laparoscopic appendicectomy was £906. Median equipment cost for laparoscopically completed cases was £254. Median total in-patient cost was £1617 (range, £880–£3360). This compared with a mean re-imbursement of £1981 representing a cost benefit of £233 per case ($P = 0.0009$).

CONCLUSIONS Despite a liberal use of disposable equipment, laparoscopic appendicectomy can still be performed within the confines of the national tariffs. There is a considerable variation in the cost of this procedure, and it may be possible to reduce costs by more stringent use of disposable equipment and standardising recovery protocols.

KEYWORDS

Laparoscopic appendicectomy – Cost – Payment by results – National tariffs – Re-imbursement

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Appendicectomy is a commonly performed procedure and, consequently, presents a considerable cost burden to the UK NHS. Over the last 10–15 years, the use of laparoscopic techniques for the surgical management of appendicitis have become ever more prevalent, and in many institutions laparoscopic appendicectomy is performed far in excess of open appendicectomy.

While laparoscopic appendicectomy may be associated with a shorter hospital stay in comparison to open appendicectomy,^{1,2} operative costs are increased due to an increased operative time and an increased use of disposable equipment.^{1,3,4} In addition, the use of disposable ports, staplers and other disposable equipment may further increase the operative costs of a laparoscopic procedure. Consequently, a discrepancy in total in-patient cost may be anticipated between laparoscopic and open appendicectomy.^{1,3,4}

‘Payment by results’ was introduced in *The NHS Plan* (2000) with the intention of linking resource allocation with activity undertaken. ‘Payment by results’ dictates that money follows patients dependent on diagnosis or procedure and, therefore, re-imburses service providers according to case-load. It seeks to ensure services are appropriately remunerated,

to reward efficient service provision and to create appropriate financial incentives. After a gradual introduction in 2003–2004, ‘payment by results’ was extended to include elective work in 2005–2006 and emergency work in 2006–2007.

It is not clear whether the ‘payment by results’ tariffs are appropriate for the incurred costs in performing laparoscopic appendicectomy. We, therefore, conducted a study to establish the cost of laparoscopic appendicectomy at our institution, and to determine whether re-imbursement according to the national tariffs was sufficient.

Patients and Methods

The study was a prospective, single-group, cross-sectional study. Ethical approval was not sought as the data were collected as part of an internal audit. Data collection took place over a 4-month period (June 2007 to September 2007). The study population comprised sequential patients undergoing emergency laparoscopic appendicectomy during the defined period at either of two teaching hospitals within a single trust. Information collected included demographic

details, operative data, drug usage and duration of hospital stay. Operative data were recorded using a proforma completed anonymously by the operating surgeon immediately upon completion of the procedure. The proforma listed the available laparoscopic equipment and other consumables requiring the surgeon to indicate the number of each item used in order to minimise data omissions. Institutional theatre costs and daily ward costs were obtained from the hospital finance department to enable cost analysis.

Analysis

All data were analysed on an intention-to-treat basis. Equipment costs, theatre costs and total in-patient costs were calculated. Cost analysis was performed by comparing the overall in-patient costs (arithmetic mean) with the reimbursement due based on the national tariffs for appendix procedures. The null hypothesis of zero cost difference was tested using the 1 sample *t*-test. Confidence intervals were validated using a bootstrap technique. One thousand repeated samples of size 50 were drawn with replacement, and bias-corrected percentile confidence intervals for the median were calculated.¹ Statistical analysis was performed using SPSS v.15 (SPSS Inc.) and STATA v.9 (StataCorp).

Results

A total of 50 laparoscopic appendicectomies were performed: 24 of the patients were male and 26 were female. Median age was 30 years. Forty-six (92%) of the procedures were completed laparoscopically, with four (8%) requiring conversion to an open procedure. Median operative time was 60 min. Median operative time for laparoscopically completed procedures was 59 min, and for laparoscopic conversions was 101 min. Median total hospital stay was

Table 1 Breakdown of costs (£) for laparoscopic appendicectomy

	Median	Range
Equipment cost	254	(111–451)
Theatre costs	663	(273–1333)
Total operative costs	906	(518–1548)
Ward costs	660	(220–2200)
Medication costs	41	(10–216)
Total in-patient cost	1632	(885–3410)
	Mean	
Total in-patient cost	1764	
Re-imbursement	1980	

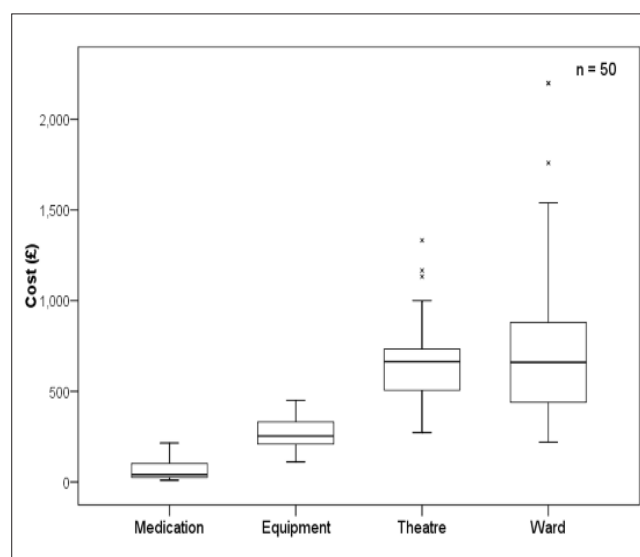


Figure 1 Box and whisker plot showing breakdown of costs of laparoscopic appendicectomy – median/inter-quartile range/range.

3 days (range, 1–10 days). No patients required a high dependency or intensive care bed.

Theatre costs were calculated based on a rate of £400 per hour. Surgical ward costs were £220 per night. Table 1 and Figure 1 show a breakdown of the costs. Median equipment cost for laparoscopically completed cases was £254 (range, £111–£451). Equipment costs comprised 29.0% of total operative costs. The mean total in-patient cost of £1765 represented a mean cost benefit of £215 per case compared with the mean re-imbursement of £1981. This difference was significant at the 1% level using both Student's *t*-test

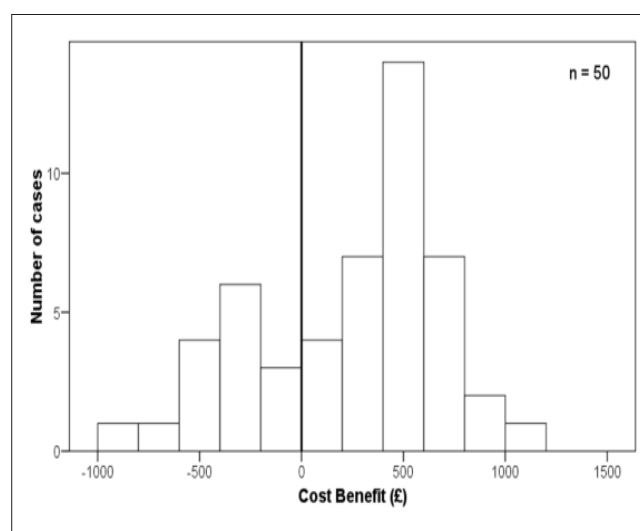


Figure 2 Distribution of cost benefit of laparoscopic appendicectomy per procedure: total procedural costs compared with re-imbursement from national tariffs.

($P = 0.002$) and bootstrap analysis ($P = 0.007$). Corresponding 99% confidence intervals were £36–£395 and £115–£540. The distribution of cost benefit is illustrated in Figure 2.

There was a significant difference in equipment costs between the two institutions ($P = 0.0003$). There were no significant differences in total operative cost ($P = 0.95$) or in the total cost of in-patient stay ($P = 0.40$).

Discussion

This is the first study assessing the cost of laparoscopic appendicectomy in relation to the UK national tariffs. As expected, we demonstrated considerable variation in the operative costs and overall in-patient costs associated with laparoscopic appendicectomy. We demonstrated that laparoscopic appendicectomy was performed within the confines of the national tariffs. As open appendicectomy is infrequently performed at our institutions, we did not attempt to address the comparative costs of open versus laparoscopic appendicectomy. Other authors have addressed these considerations.^{1,5,4}

Our trust uses a detailed 'bottom-up' cost analysis by service line reporting to estimate theatre and ward costs. More accurate cost analysis may be achievable if patient level costs are used. However, national tariffs for procedures are based on the average estimated cost for a procedure across all trusts, and these trust estimates have generally not utilised such financial methods. A consequence of this method of tariff generation is that as the ratio of appendicectomies performed laparoscopically increases, the tariffs will move toward the average cost of laparoscopic appendicectomy, although a time lag is inevitable.

There was a more liberal attitude to the use of disposable equipment at one of the institutions than the other. While this was reflected by increased equipment costs, there was no increase in overall operative cost, and it seems plausible that there is a trade-off between the additional costs incurred with the use of disposable equipment, and the potential costs saved if operative time is reduced. It may be possible to generate further cost savings by standardising disposable equipment used. To optimise this process, the individual cost utility of laparoscopic instruments needs to be determined. For example, the additional material cost of using endoloops (£8.50 each at our institution) is likely to be more than compensated for by a reduced operative time

when compared to intracorporeal ligation. Whether the same cost utility can be obtained using laparoscopic staplers and other disposable equipment is less clear. A further consideration is the potential for a reduction in complications (and overall costs) with the use of specific equipment. For example, the use of endoscopic staplers may be associated with a reduced risk of abscess formation when compared to appendix ligation.⁶

The majority of incurred costs were a consequence of in-patient stay. Therefore, considerable cost savings could be generated by reducing pre- and postoperative stay. It has been demonstrated that early discharge following emergency appendicectomy is safe and not associated with significant re-admission rates. Therefore, implementation of guidelines to optimize pre- and postoperative management, with a policy of early postoperative discharge has the potential for significant cost savings, and consequent generation of revenue for service providers.

Conclusions

Despite a liberal use of disposable equipment, laparoscopic appendicectomy can still be performed within the confines of the national tariffs. We have demonstrated there is a considerable variation in the cost of this procedure, and it may be possible to reduce costs by more stringent use of disposable equipment and standardising recovery protocols.

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